

# **Quantitative Measures of Benefits from Rural Electrification in the Philippines**

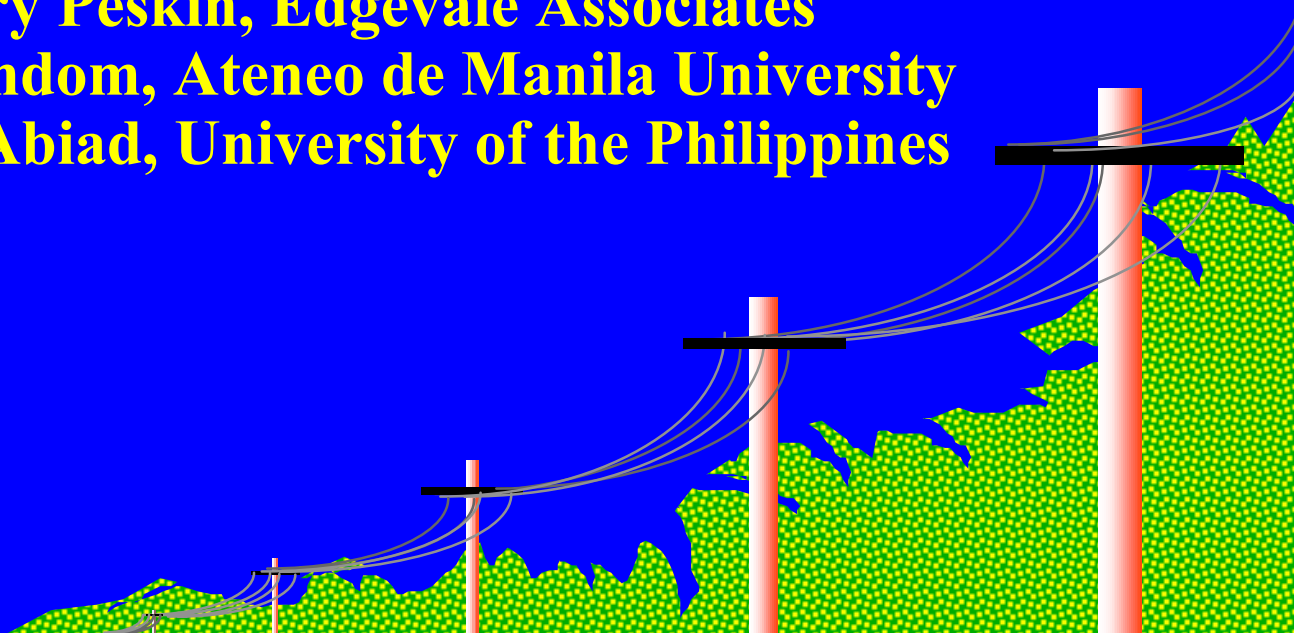
by

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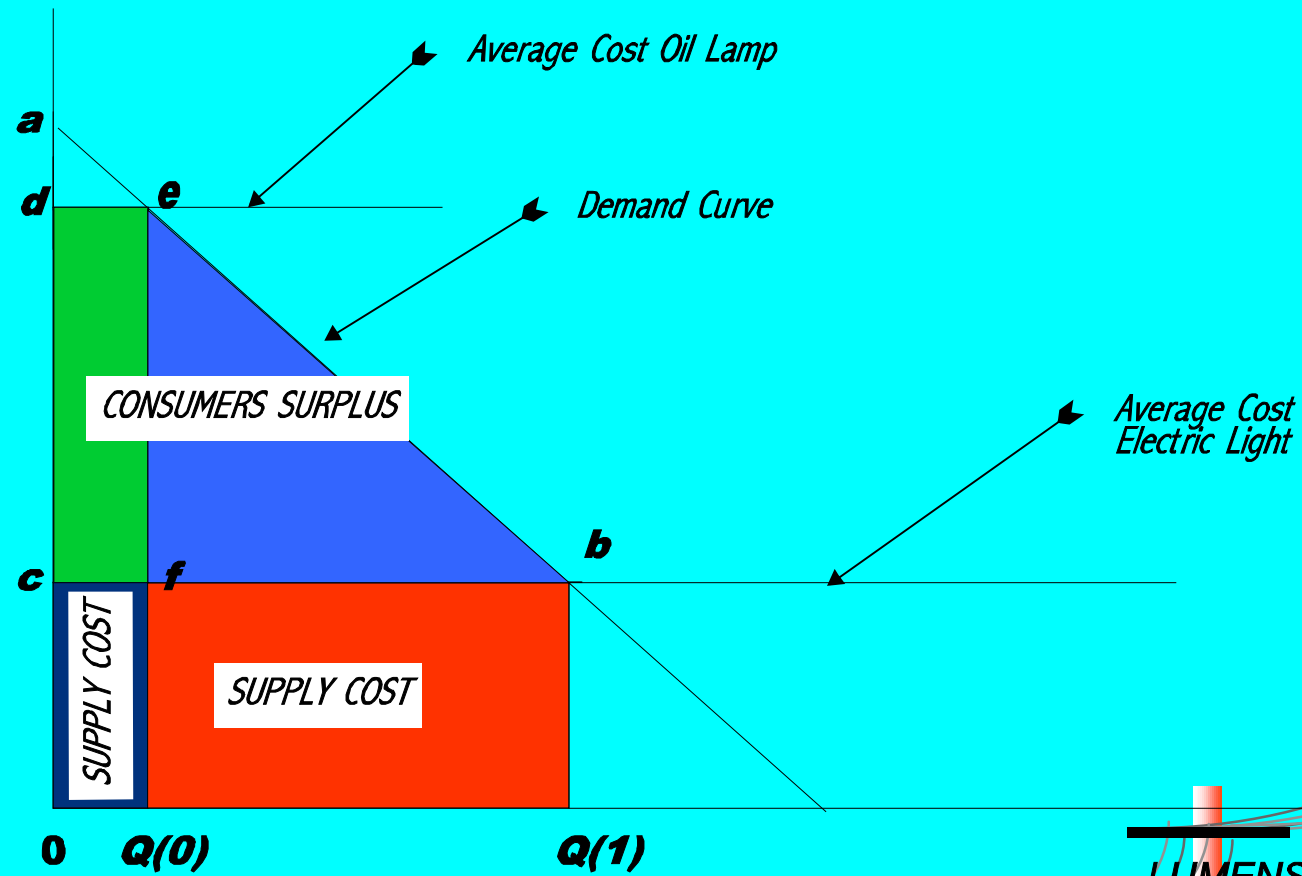
# Purpose of the Study

- Further develop Bank's methods to measure benefits of rural electrification
- Relate rural electrification more closely to rural development outcomes
- Quantify some of the “unquantifiable” benefits such as impact on education

# Traditional World Bank Approach

- DEMAND FOR ELECTRICITY IS A DERIVED DEMAND FOR:
  - LIGHT (LUMENS)
  - OTHER POWER NEEDS (E.G., FOR IRRIGATION)
- ELECTRICITY ALLOWS THESE DEMANDS TO BE SATISFIED AT LOWER COSTS
- ESTIMATE BENEFITS FROM PRIMARY DEMAND CURVES OR FROM COST SAVINGS

# Demand For Lumens

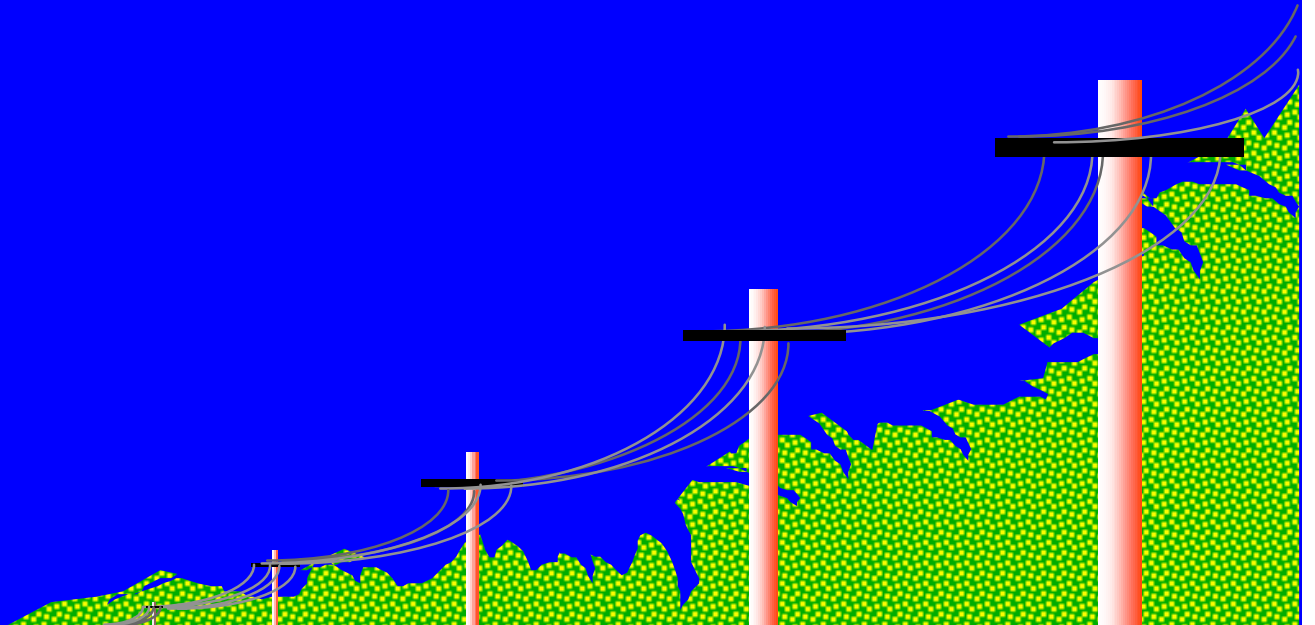


# Key Assumptions

- FUNCTIONAL FORM OF DEMAND IS KNOWN
- DEMAND IS INDEPENDENT OF SOURCE OF LUMENS
- ASSUMES SINGLE DEMAND CURVE FOR RICH AND POOR
  - THUS, BENEFITS COULD BE OVERSTATED
    - » ERROR IS LESS THE MORE THE PROJECT RAISES INCOME

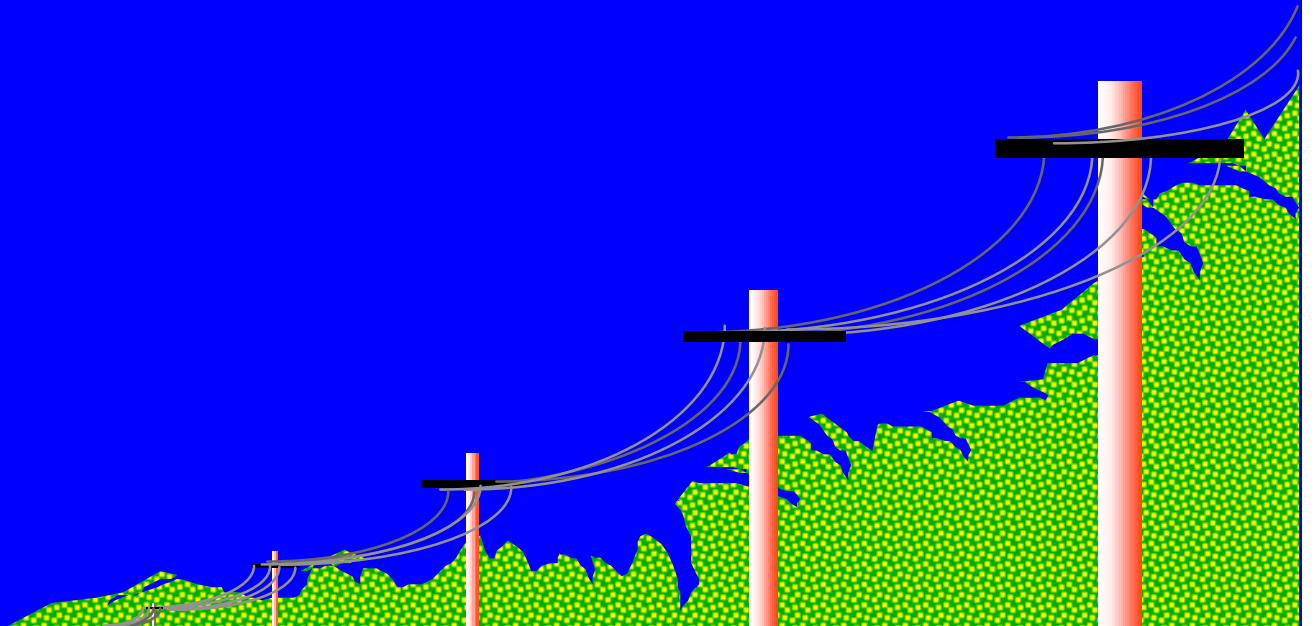


# Extension Of The Traditional World Bank Approach: The Philippines Project



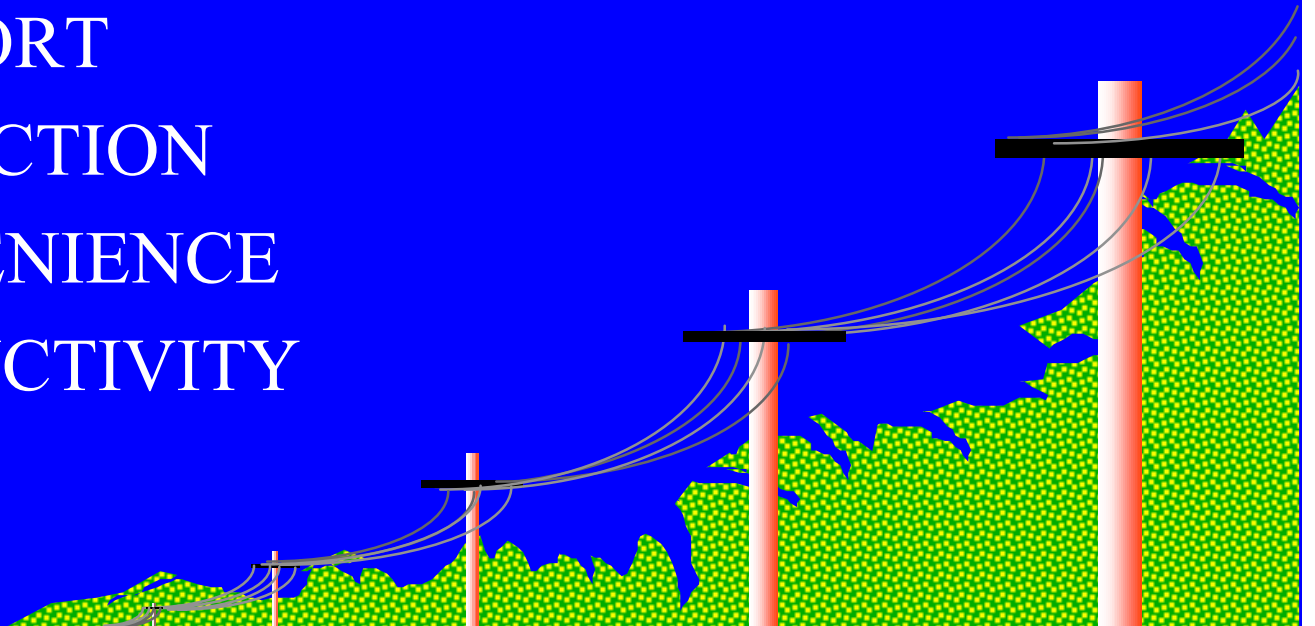
## Key Feature:

- EXTENSION OF THE LIST OF PRIMARY DEMANDS BEYOND DEMAND FOR LUMENS OR DEMAND FOR COST SAVINGS



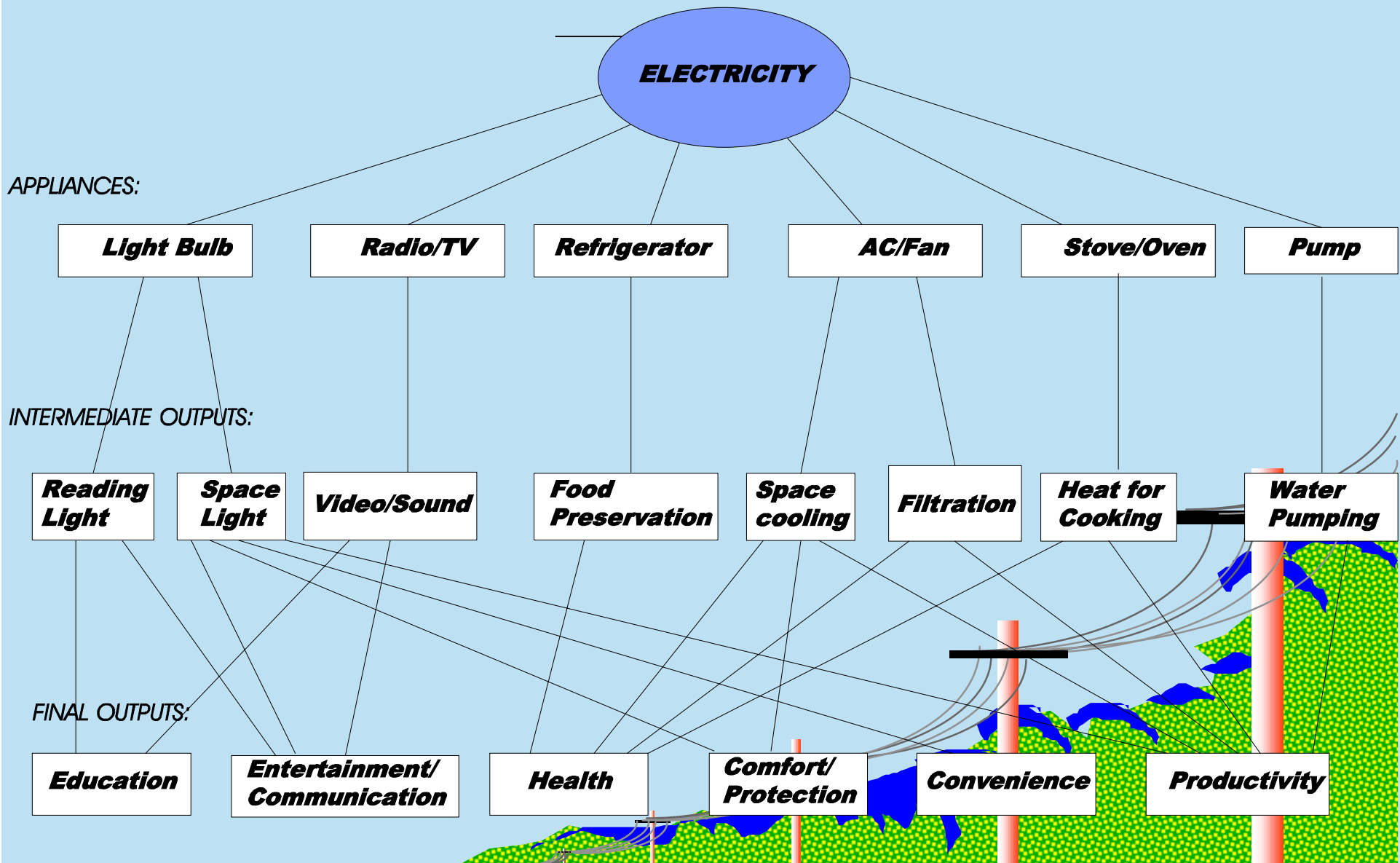
# Demand For Electricity Is Derived From Demand For:

- EDUCATION
- ENTERTAINMENT
- HEALTH
- COMFORT
- PROTECTION
- CONVENIENCE
- PRODUCTIVITY



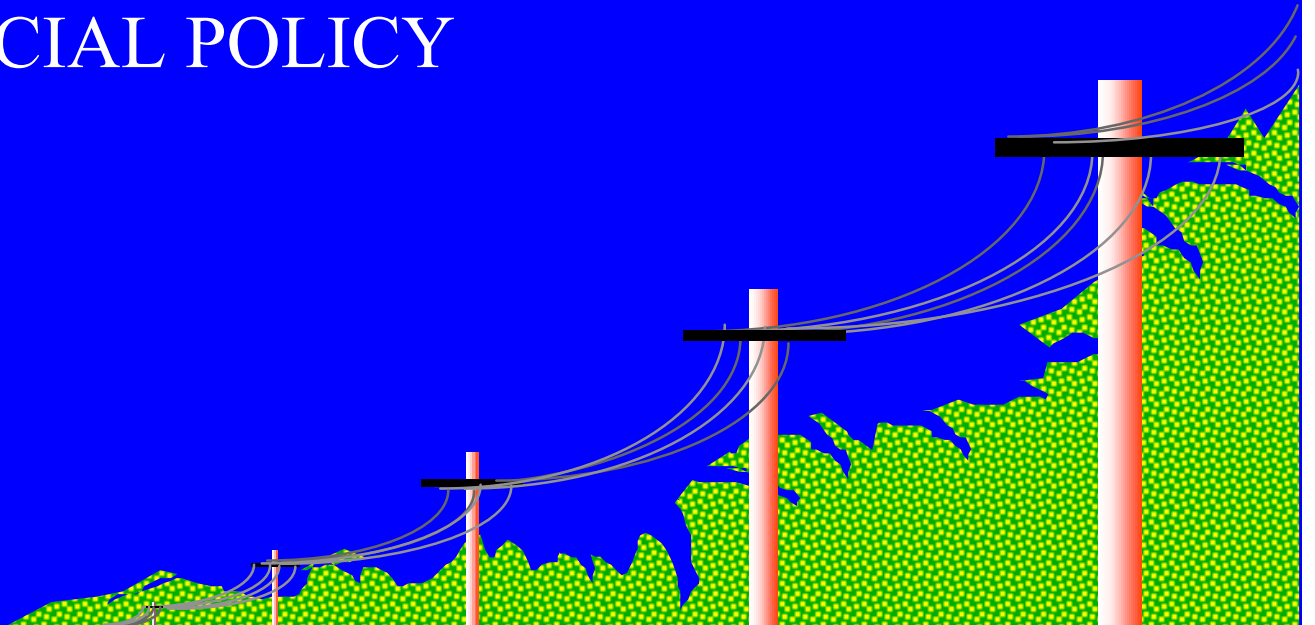


# Derived Demand “Model”



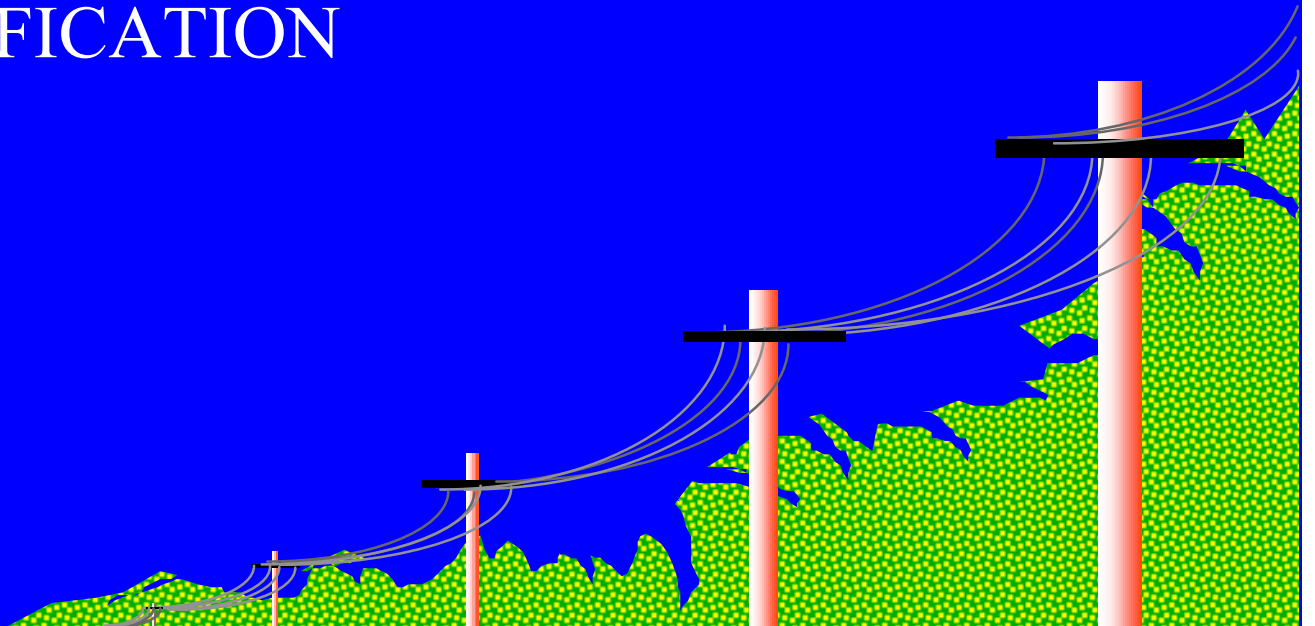
## Method Of Approach

- HOUSEHOLD SURVEY
- COMMUNITY SURVEY
- APPLICATION OF BENEFITS MEASUREMENT TECHNIQUES USED TO EVALUATE ENVIRONMENTAL AND OTHER SOCIAL POLICY



## Household Survey

- 2000 HOUSEHOLDS, ABOUT 67 PERCENT ELECTRIFIED
- QUESTIONS RELATED TO BEHAVIORAL RESPONSES TO RURAL ELECTRIFICATION
- QUESTIONS ON ATTITUDES ABOUT RURAL ELECTRIFICATION

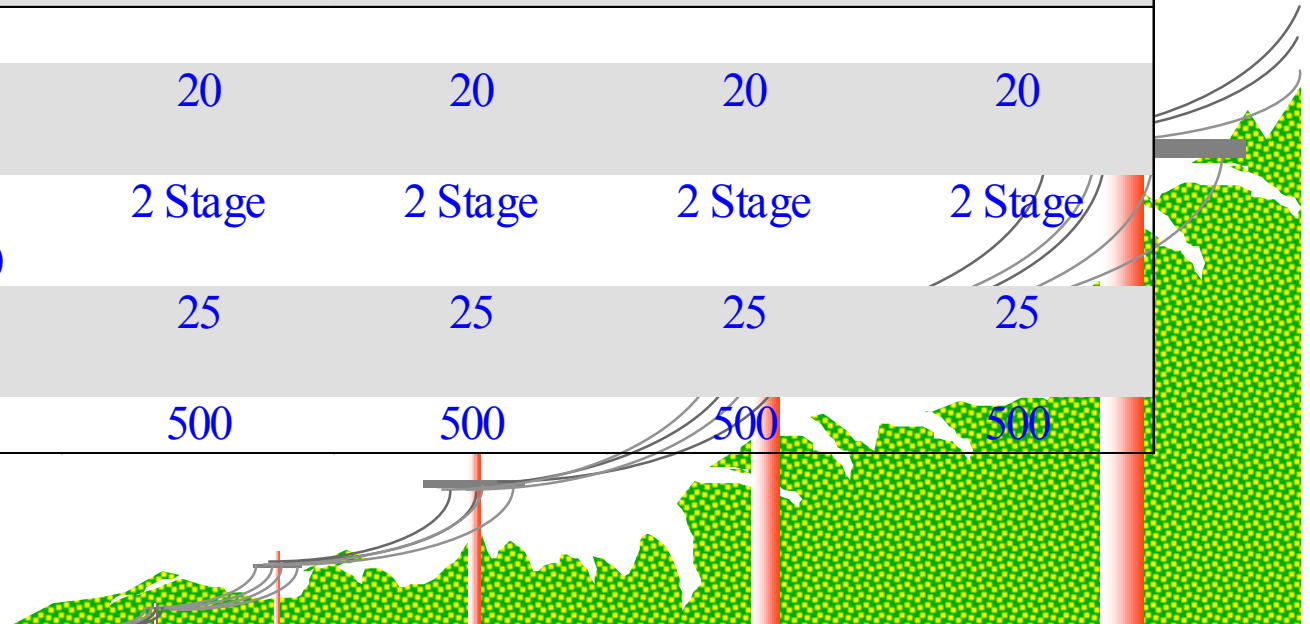


# Background on Electric Cooperatives in Survey

Region	Mountain Province	Nueva Ecija	Batangas	Camarines Sur	Philippines (1995 Nationwide Survey)
Census for Political Area					
Population (Thousands)	130	1,505	1,658	1,432	68,075
% of Population Rural	91	61	73	65	50
Literacy	81	97	96	96	95
Survey of 4 Electric Cooperatives					
% Rural in Cooperatives	100%	100%	100%	100%	
Rural Income Per capita/ Month	1,570	2,496	1,294	1,109	1,077
Exp on Energy/ Month	237	336	416	249	NA

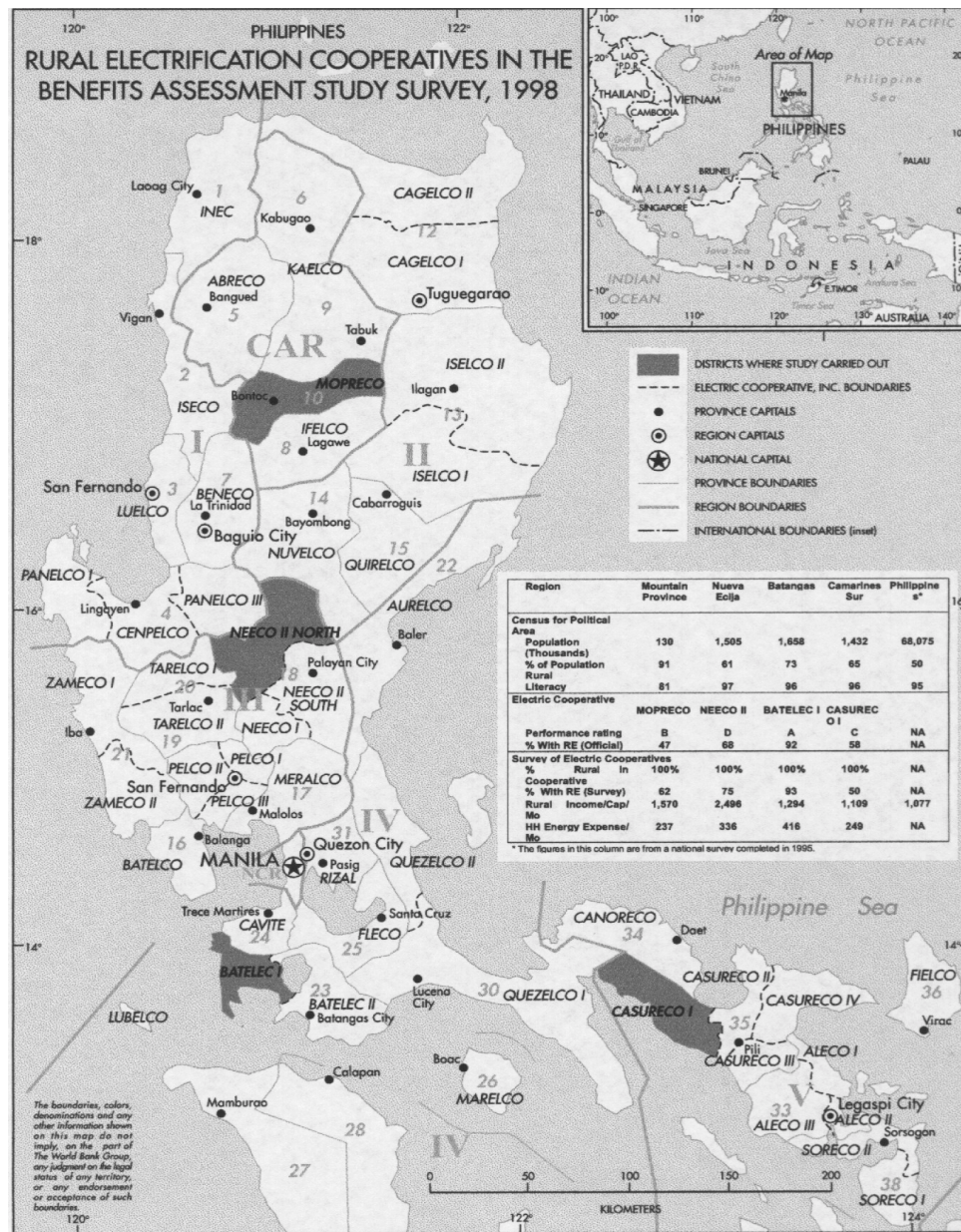
# Sampling Procedure

Region	Mountain Province	Nueva Ecija	Batangas	Camarines Sur
Electric Cooperative (Purposive Selection)	MOPRECO	NEECO II	BATELEC I	CASURECO I
Performance rating	B	D	A	C
Official Connections '96	47	68	92	58
Survey Connections '98	62	75	93	50
Survey				
Barangay Questionnaire Sample	20	20	20	20
Stratification Method (Based on proportion with electricity)	2 Stage	2 Stage	2 Stage	2 Stage
HH interviewed in Each Barangay	25	25	25	25
Total Households	500	500	500	500





# Map of Survey Areas

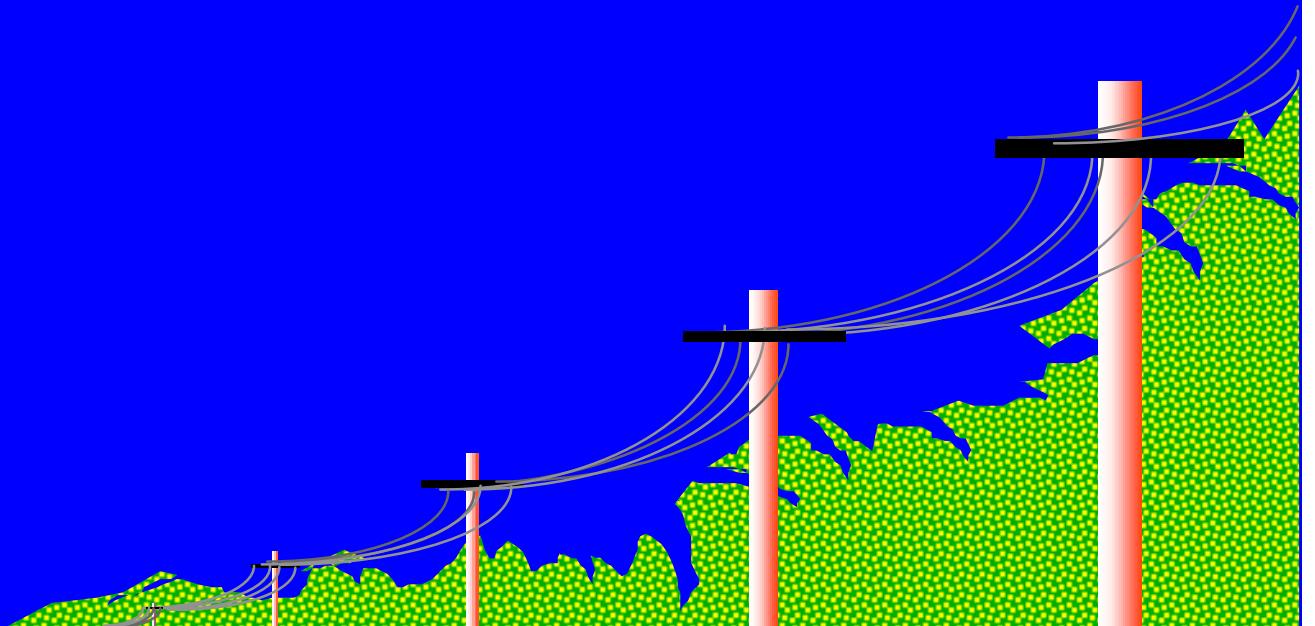


# Questionnaire Design

- Barangay Survey
  - Distance to infrastructure
  - Availability of energy services
- Household Survey
  - Socioeconomic information on HH members
  - HH energy use
  - Farming characteristics
  - Attitudes & Appliance Use
- Note: 40 Pesos = 1 Dollar

# Two Steps in Benefits Estimation

1. ESTIMATION OF “PHYSICAL” RESPONSE TO ELECTRIFICATION
2. VALUATION OF ESTIMATED PHYSICAL RESPONSE

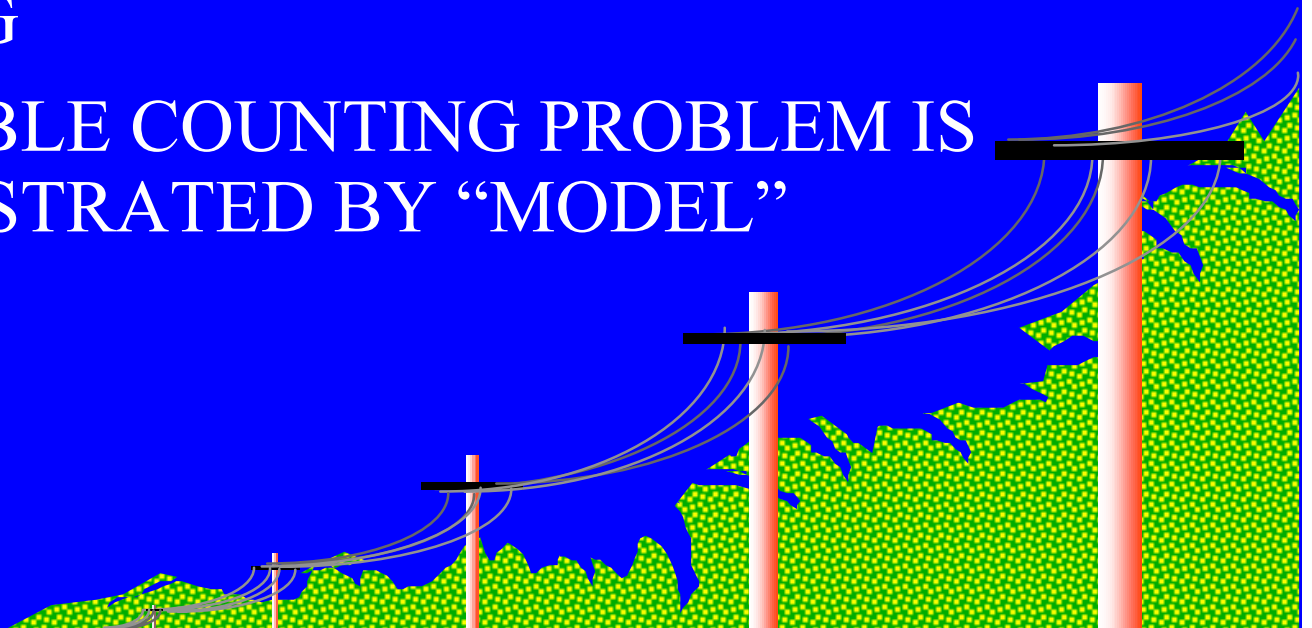




## We Intend to Use Conventional Approaches As Well

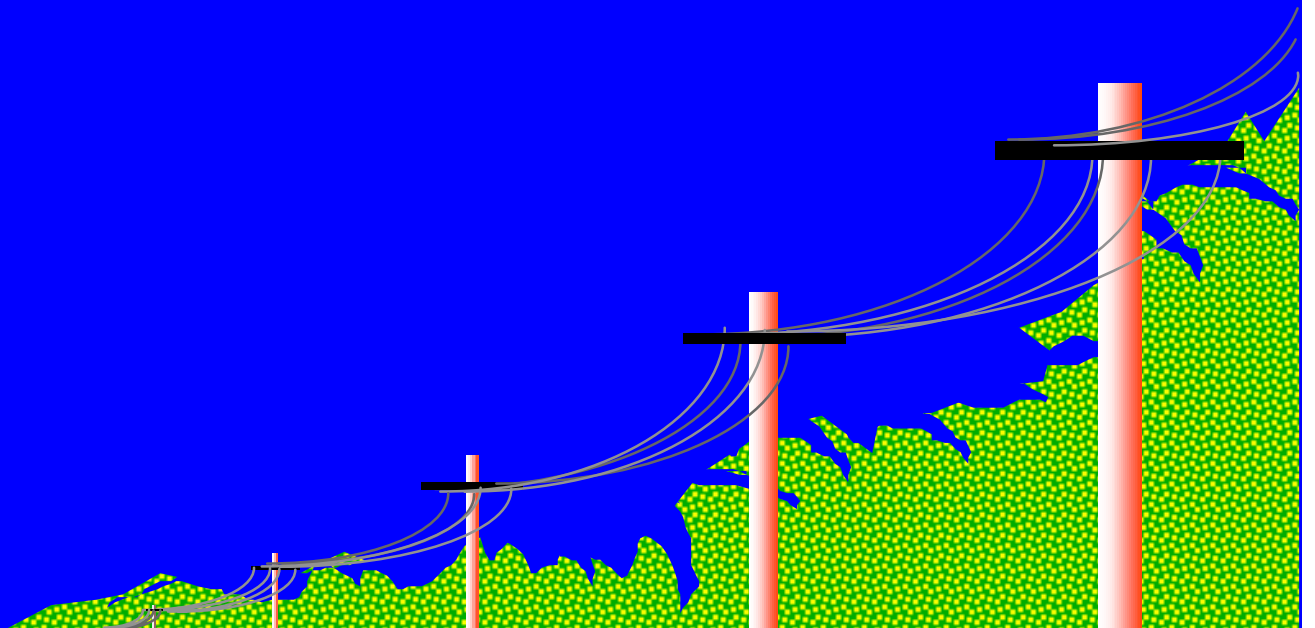
- EASILY APPLIED FOR LUMENS DEMAND AND FOR SAVINGS DUE TO MOVES FROM BATTERIES TO HOUSE CURRENT FOR RADIOS
- MUST BE CAREFUL TO AVOID DOUBLE COUNTING

» DOUBLE COUNTING PROBLEM IS ILLUSTRATED BY “MODEL”



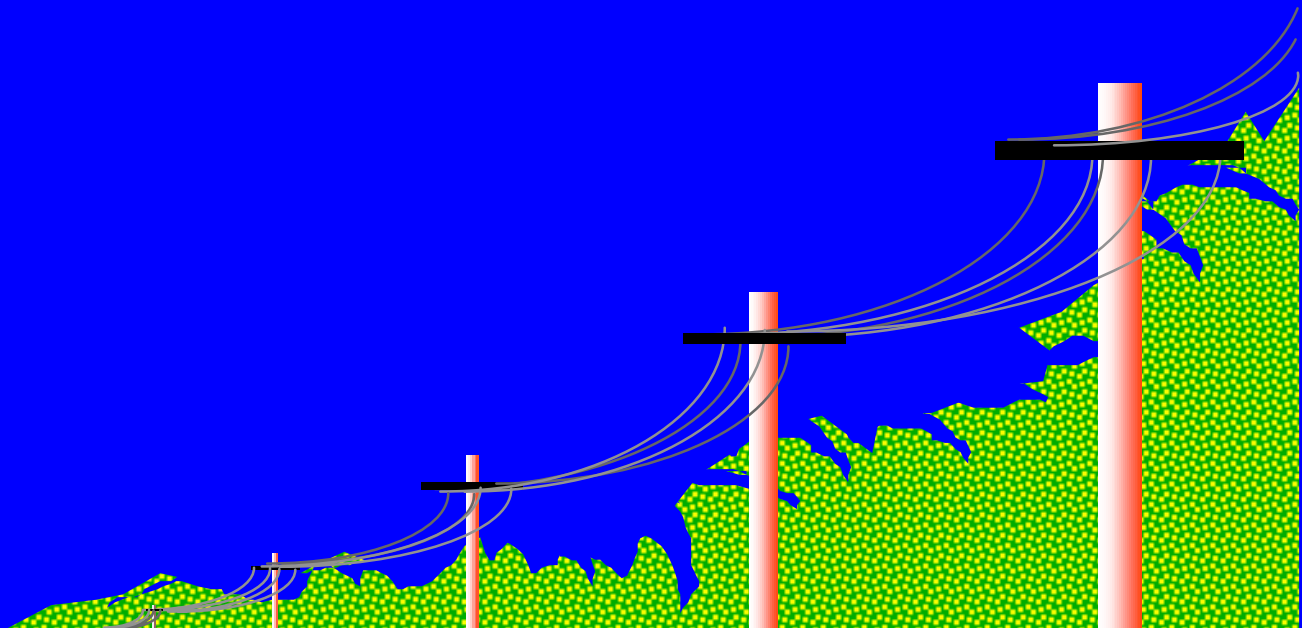
# Some Empirical Findings

- BENEFIT ESTIMATES REFER TO THE **GAIN IN BENEFITS** FROM ELECTRIFYING PREVIOUSLY UNELECTRIFIED HOUSEHOLDS



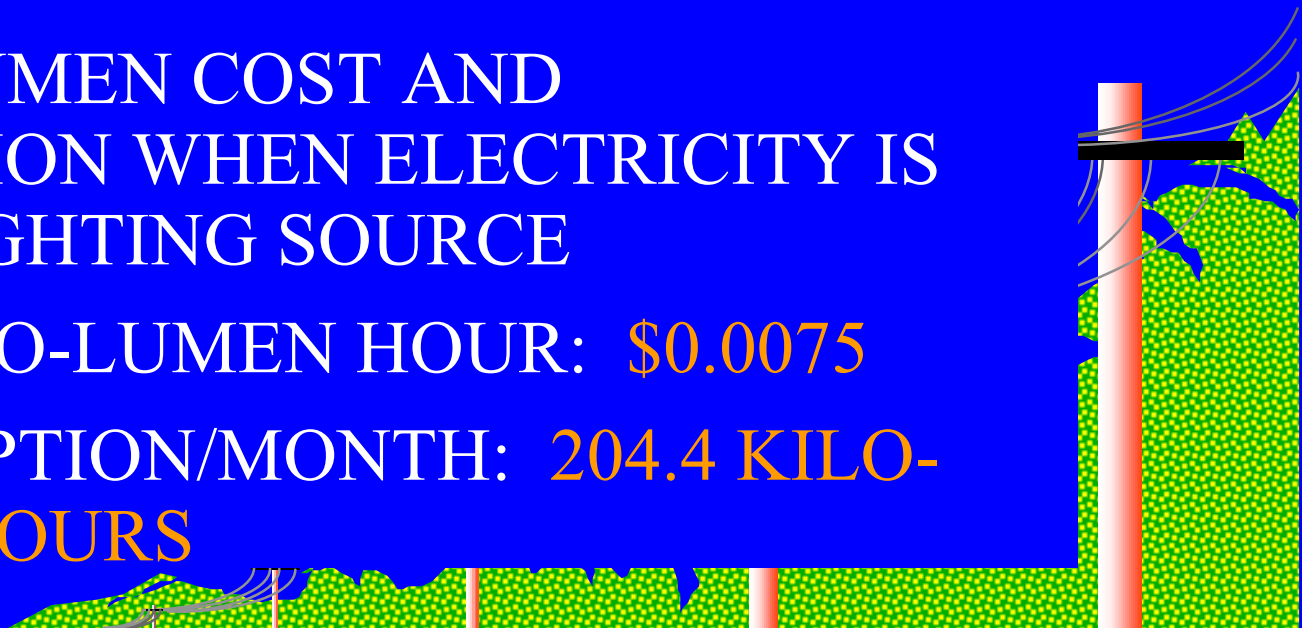
# More-Traditional Estimates

- BENEFIT GAINS DUE TO CHEAPER SOURCE OF LUMENS
- BENEFIT GAINS DUE TO CHEAPER RADIO AND TV



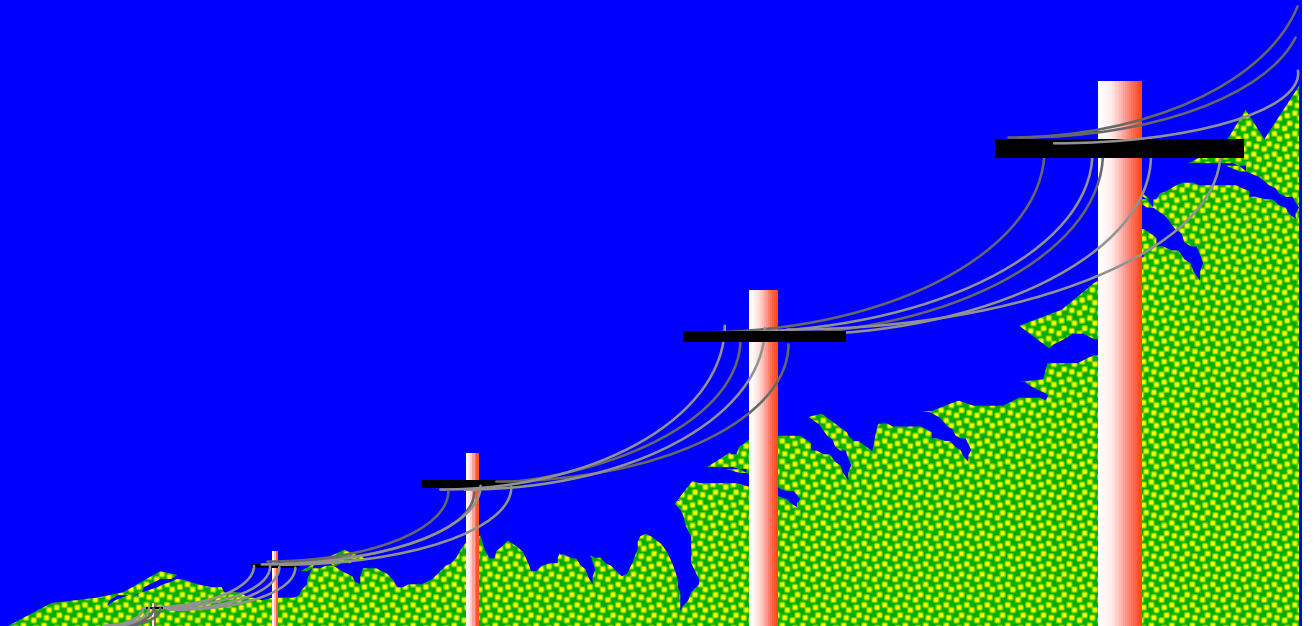
# Cheaper Lumens

- TYPICAL LUMEN COST AND CONSUMPTION WHEN KEROSENE IS USED AS LIGHTING SOURCE
  - COST/KILO-LUMEN HOUR: \$0.36
  - CONSUMPTION/MONTH: 4.1 KILO-LUMEN HOURS
- TYPICAL LUMEN COST AND CONSUMPTION WHEN ELECTRICITY IS USED AS LIGHTING SOURCE
  - COST/KILO-LUMEN HOUR: \$0.0075
  - CONSUMPTION/MONTH: 204.4 KILO-LUMEN HOURS



# Gain from Cheaper Lumens

- BENEFIT/MONTH/HOUSEHOLD: \$36.75
- TOTAL PHILIPPINE BENEFIT: \$147.5  
MILLION/MONTH



# Cheaper Radio Listening Hours

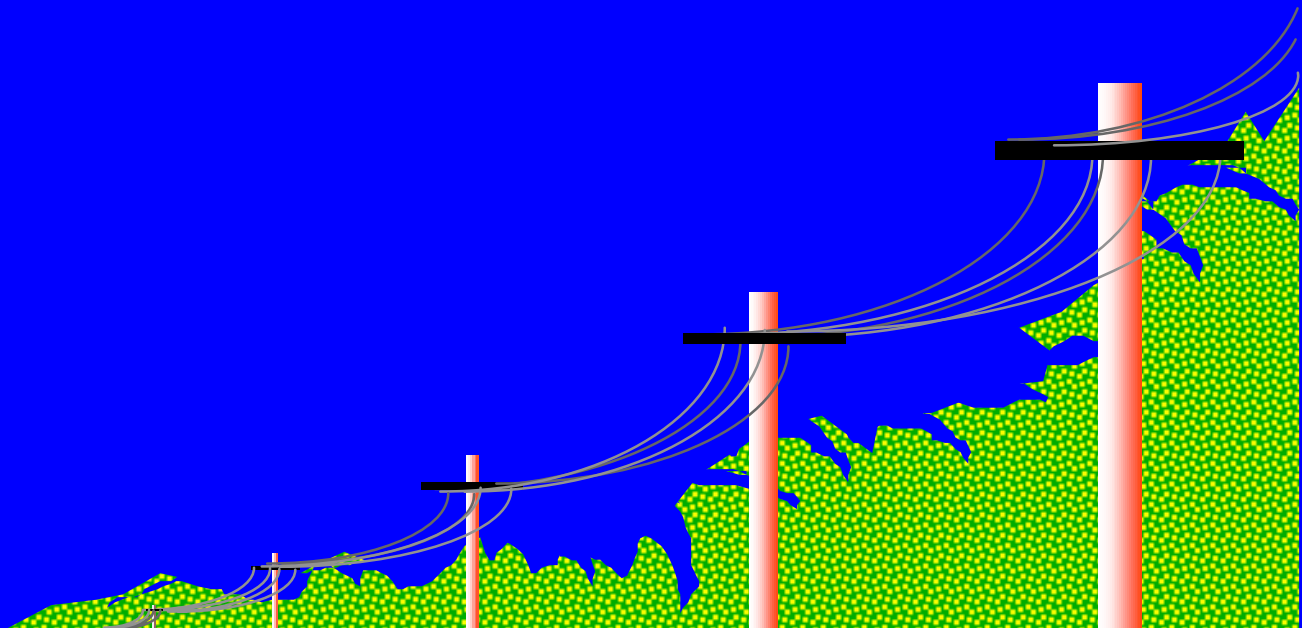
- TYPICAL RADIO HOURLY COST AND CONSUMPTION USING DRY CELLS AS POWER SOURCE
  - COST/HOUR: \$0.11
  - HOURS/MONTH: 13.8 HOURS
- TYPICAL RADIO HOURLY COST AND CONSUMPTION USING HOUSEHOLD CURRENT AS POWER SOURCE
  - COST/HOUR: \$0.0028
  - HOURS/MONTH: 104.6 HOURS

# Cheaper TV Viewing Hours

- TYPICAL TV HOURLY COST AND CONSUMPTION USING A CAR BATTERY AS POWER SOURCE
  - COST/HOUR: \$0.22
  - HOURS/MONTH: 1.85 HOURS
- TYPICAL TV HOURLY COST AND CONSUMPTION USING HOUSEHOLD CURRENT AS POWER SOURCE
  - COST/HOUR: \$0.0125
  - HOURS/MONTH: 129.0 HOURS

# Gain from Cheaper Radio and TV Hours

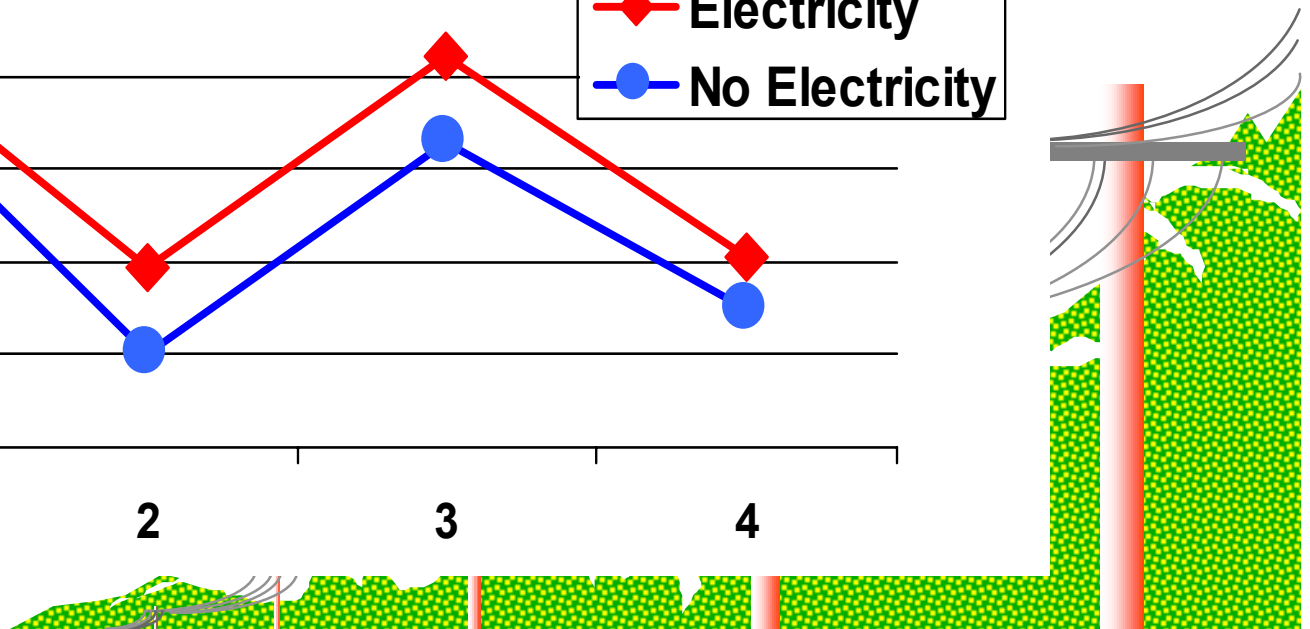
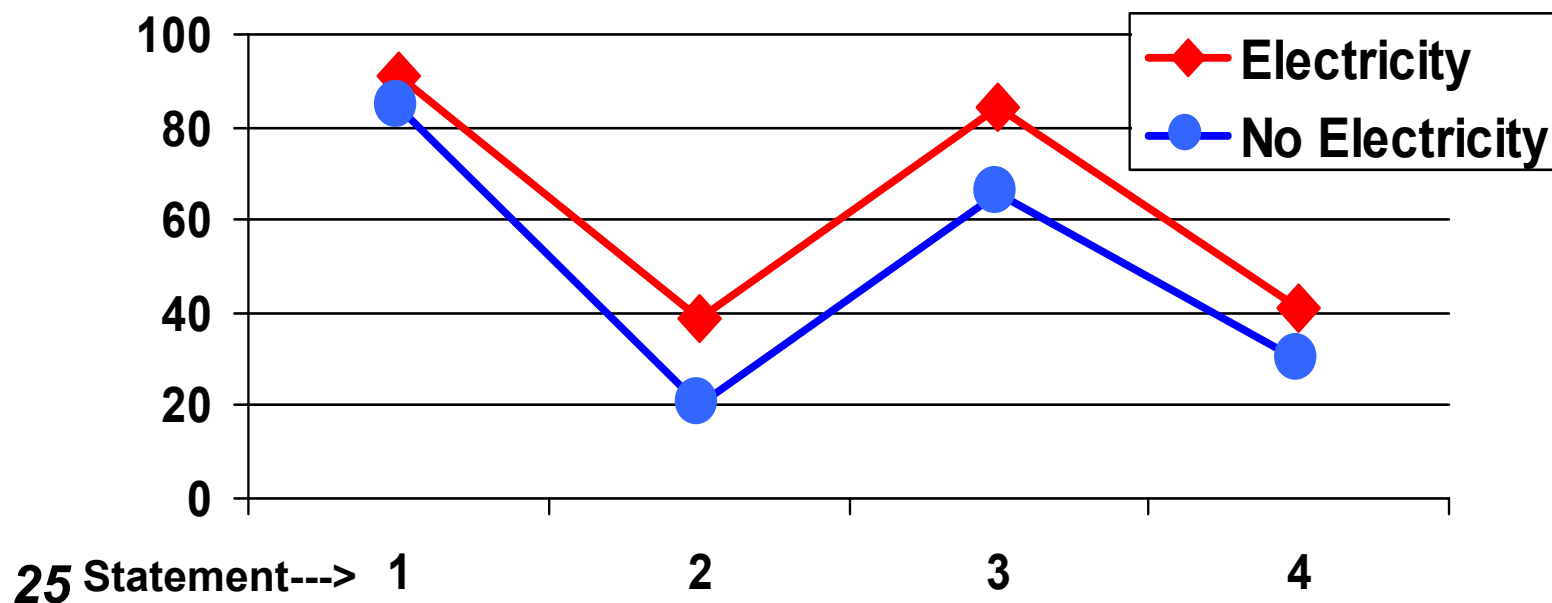
- BENEFIT/MONTH/HOUSEHOLD: \$19.60
- TOTAL PHILIPPINE BENEFIT: \$77.5 MILLION/MONTH





# Communications and Socializing

- 1 Watching TV is a great source of news and entertainment (% agree)
- 2 It is difficult to get news and information (% disagree)
- 3 Watching TV provides great entertainment
- 4 We receive guests in the evening after dark.



# Less-Traditional Estimates

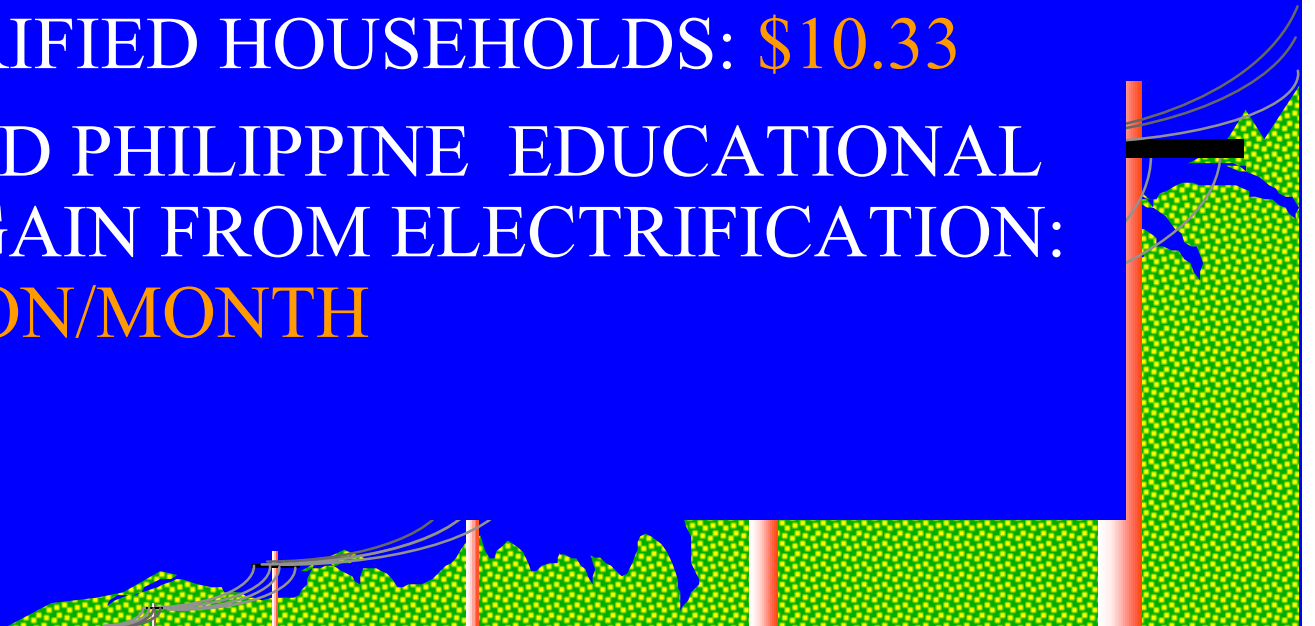
## ■ BENEFITS FROM:

- IMPROVED EDUCATION
- SAVINGS IN TIME TO DO HOUSEHOLD CHORES
- IMPROVED PRODUCTIVITY OF HOME BUSINESSES



## Improved Education

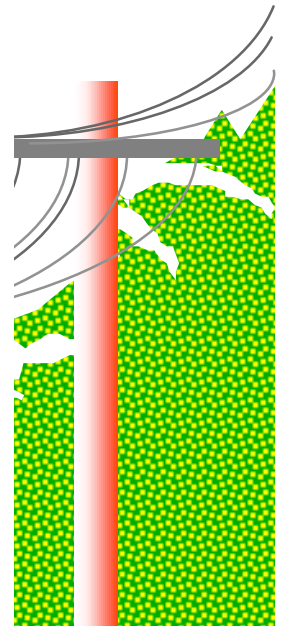
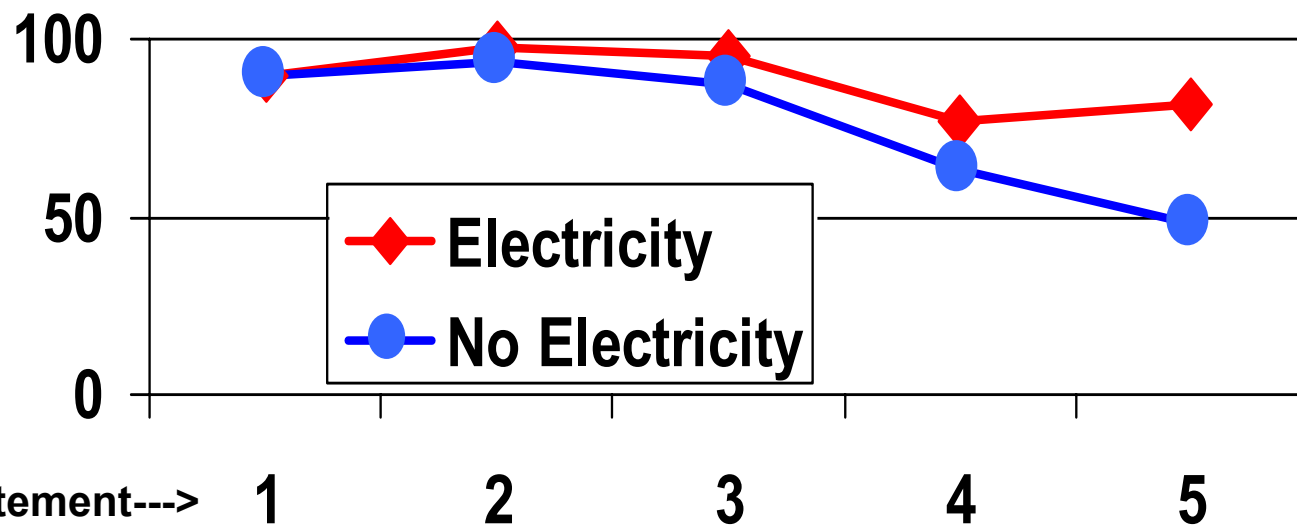
- ADDITIONAL INCOME/YEAR OF ADDITIONAL EDUCATION: \$68
- ADDITIONAL YEARS OF EDUCATION IN ELECTRIFIED HOUSEHOLDS: 1.82 YEARS
- MONTHLY BENEFIT/ EMPLOYED ADULT IN ELECTRIFIED HOUSEHOLDS: \$10.33
- ESTIMATED PHILIPPINE EDUCATIONAL BENEFIT GAIN FROM ELECTRIFICATION: \$80 MILLION/MONTH



# Education

(% agreeing with statement)

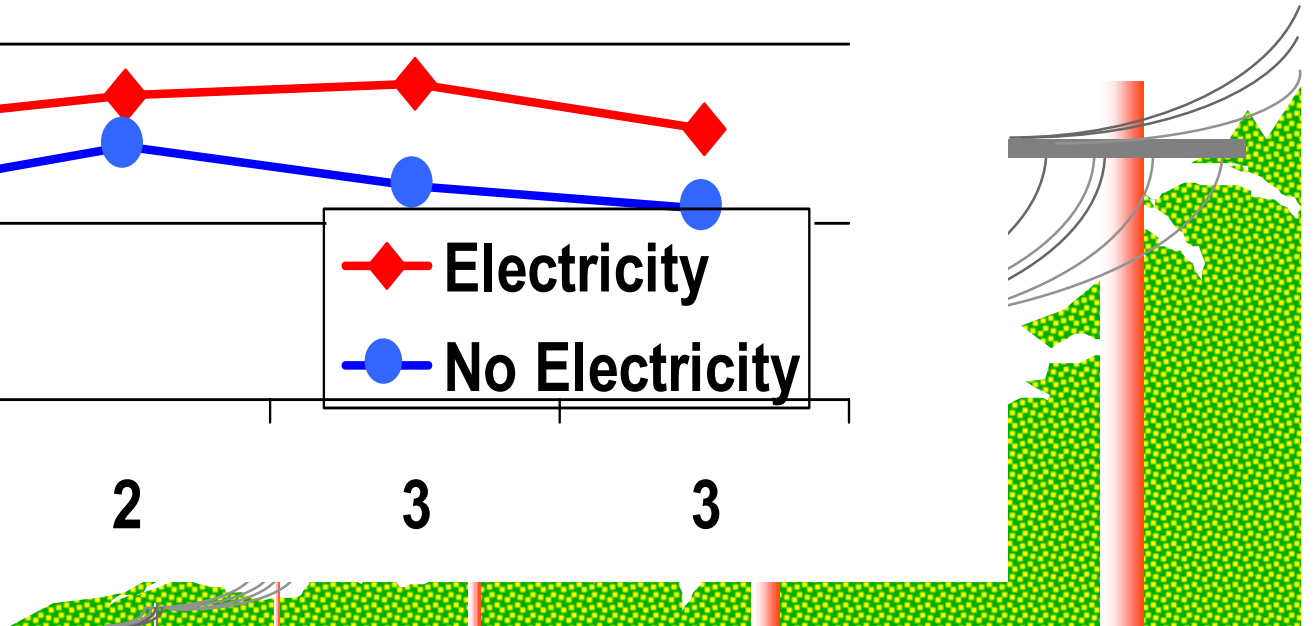
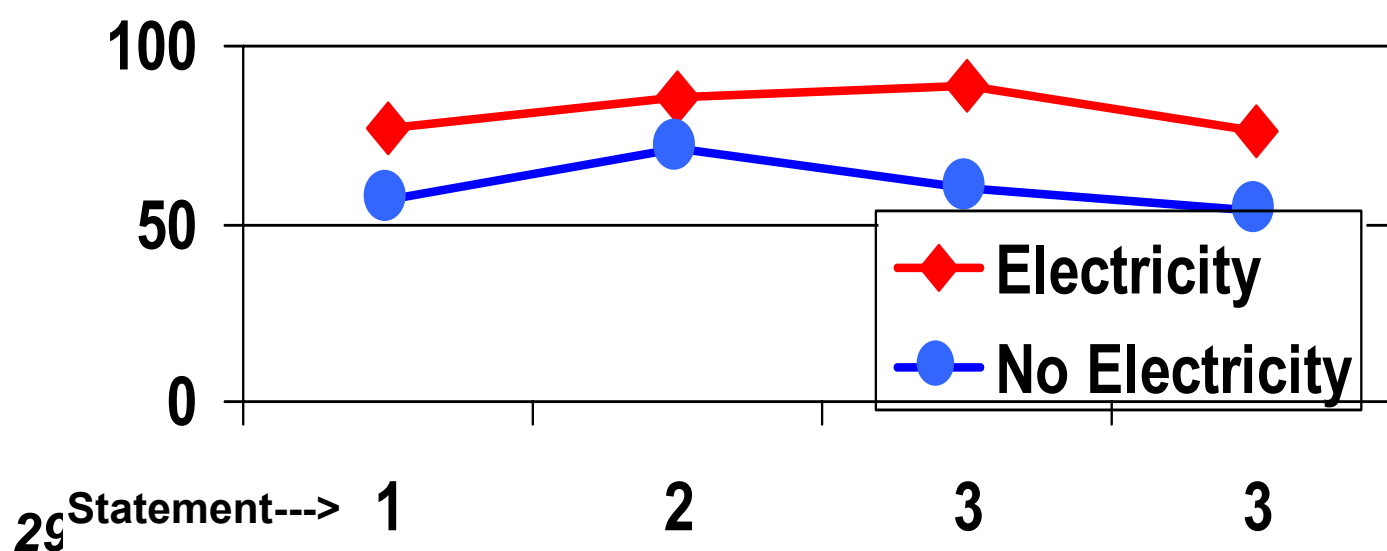
1. Reading is easier with electricity compared to kerosene
2. Having electricity is important for a child's education
3. Because of good light, children study more at night
4. My children study in the evening after dark
5. In my house it is easy to read in the evening.



# Light and Studying

(% agreeing with statement)

1. My family is happy with light from current fuel
2. Television takes study time away from children
3. I complete work in my house during the evening after dark.
4. Lighting with kerosene can cause health problems..



# Less-Traditional Estimates

## ■ BENEFITS FROM:

- IMPROVED EDUCATION
- SAVINGS IN TIME TO DO HOUSEHOLD CHORES
- IMPROVED PRODUCTIVITY OF HOME BUSINESSES



# Education Benefits Reflect

- POSITIVE ATTITUDE TOWARDS ELECTRICITY AND EDUCATION
  - OVER 98% BELIEVE THAT ELECTRICITY IS IMPORTANT FOR CHILDREN'S EDUCATION
  - OVER 95% BELIEVE THAT CHILDREN STUDY MORE WITH GOOD LIGHT
- ACTUAL INCREASE IN STUDY TIME
  - ABOUT 14 HOURS/MONTH MORE IN ELECTRIFIED HOUSEHOLDS



# Savings in Time

- GAIN IN LEISURE TIME FROM ELECTRIFICATION: 33 HOURS/MONTH
- VALUE OF ADDITIONAL LEISURE TIME/HOUSEHOLD: \$24.50/MONTH
- TOTAL VALUE OF ADDITIONAL LEISURE TIME IN PHILIPPINES: \$97.5 MILLION/MONTH





# Improved Home Business Productivity

- ADDITIONAL BUSINESS HOURS/MONTH DUE TO ELECTRIFICATION: 48 HOURS
- GAIN IN HOUSEHOLD INCOME FROM ADDITIONAL BUSINESS HOURS: \$36/MONTH
- ESTIMATED TOTAL GAIN IN PHILIPPINES: \$30 MILLION/MONTH



# Summary of Benefits Per Month

## Potential Benefit for 4 million HH with No Electricity

<b>Benefit/Gain</b>	<b>US\$ Benefit/ Unit Month</b>	<b>US\$ Benefit/ Household /Month</b>	<b>Total Potential Philippine Benefit (Million US\$ /month)</b>
<b>Cheaper Lumens (per HH)</b>	<b>37</b>	<b>37</b>	<b>147</b>
<b>Cheaper Radio/TV (per HH)</b>	<b>19</b>	<b>19</b>	<b>77</b>
<b>Education (per Employed Adult)</b>	<b>6</b>	<b>20</b>	<b>80</b>
<b>Time Savings (per HH)</b>	<b>24</b>	<b>24</b>	<b>97</b>
<b>Business Productivity (per Business only)</b>	<b>36</b>	<b>8</b>	<b>30</b>
<b>Total (excl. Lumens)</b>			<b>284</b>

# Conclusions

- BENEFIT GAIN IS SUBSTANTIAL
  - REFLECTS RELATIVELY HIGH PHILIPPINE INCOMES (BETWEEN \$125 AND \$250/MONTH IN SURVEY)
- ROUGH ESTIMATES SUGGEST THAT EVEN HIGH COST SUPPLY (\$20-\$25/MONTH) IS:
  - “WORTH IT” SOCIALLY
  - AFFORDABLE (WITH APPROPRIATE INCOME DISTRIBUTION POLICY)

# Conclusions

- OUTCOMES MAY BE DIFFERENT FOR DIFFERENT COUNTRIES. FOR EXAMPLE, THERE WERE NOT IRRIGATION BENEFITS FOR THE PHILIPPINES.
- SUCH TECHNIQUES ARE LONG OVERDUE IN EVALUATING SOCIAL INFRASTRUCTURE PROJECTS
- THEY OFFER BETTER UNDERSTANDING OF THE RELATIONSHIP BETWEEN SOCIAL INFRASTRUCTURE AND DEVELOPMENT OUTCOMES.